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ABSTRACT

A cost benefit study was conducted to determine the effectiveness of a computer assisted instruction/computer management system (CAI/CMS) as an alternative to conventional methods of teaching reading within Chapter 1 and DPPF funded programs of the Columbus (Ohio) Public Schools. The Chapter 1 funded Compensatory Language Experiences and Reading (CLEAR) program, serving elementary and middle schools, included both regular and CAI/CMS groups. A variety of computer instructional systems were used at these levels, the most prevalent being Prescription Learning in grades four and five and Dolphin at the middle school level. The DPPF funded Secondary Developmental Reading (SDR) program at the high school level included a regular group and a CAI/CMS group that used Prescription Learning techniques. Cost analysis base figures included salaries plus benefits for teachers and aides, as well as computer equipment and service contract costs. Comparative analysis between Regular and CAI/CMS units was examined in terms of enrollment, attendance, and achievement. Findings indicated that the per-pupil cost was greater in the CAI/CMS groups than in the regular groups at all three levels. The CAI/CMS groups surpassed the Regular group in achievement at the middle school level and in grades four and five, while a negative change occurred at the high school level. Findings also indicated that CAI/CMS teachers served more pupils per teacher than did regular program teachers, and that CAI/CMS pupils surpassed regular program pupils in attendance at all levels. (Tables of data are included.) (NKA)

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Education Consolidation and Improvement Act - Chapter 1

COST-BENEFIT ANALYSIS FOR ECIA CHAPTER 1 AND STATE DPPF PROGRAMS COMPARING GROUPS RECEIVING REGULAR PROGRAM INSTRUCTION AND GROUPS RECEIVING COMPUTER ASSISTED INSTRUCTION/COMPUTER MANAGEMENT SYSTEM (CAI/CMS)

July 1987

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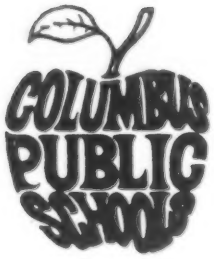

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Education Consolidation and Improvement Act - Chapter 1

COST-BENEFIT ANALYSIS FOR THE ECIA CHAPTER 1 AND STATE DPPF PROGRAMS COMPARING GROUPS RECEIVING REGULAR PROGRAM INSTRUCTION AND GROUPS RECEIVING COMPUTER ASSISTED INSTRUCTION/COMPUTER MANAGEMENT SYSTEM (CAI/CMS) 1986-87

ABSTRACT

Purpose of Study: A cost benefit study was conducted to determine the effectiveness of computer assisted instruction/computer management system (CAI/CMS) as an alternative to more conventional methods of teaching reading within Chapter 1 and DPPF funded programs of the Columbus Public Schools.

Description of Programs: The Chapter 1 funded Compensatory Language Experiences and Reading (CLEAR) program, serving elementary and middle schools, included both Regular and CAI/CMS groups. A variety of computer instructional systems were used at these levels, the most prevalent being Prescription Learning in grades 4-5 and Dolphin at the middle school level. The DPPF funded Secondary Developmental Reading (SDR) program at the high school level included a Regular group and a CAI/CMS group that used Prescription Learning techniques.

Methodology: Base figures for cost analysis included salaries plus fringes for teachers and aides, and contract costs for computer equipment and services. Comparative analysis between Regular and CAI/CMS units was done in terms of enrollment, attendance, and achievement.

Major Findings: The cost per pupil was greater in the CAI/CMS groups than in the Regular groups at all three organizational levels. In terms of achievement gains, the CAI/CMS group surpassed the Regular group by 2.8 NCE's at the middle school level and by 1.3 NCE's in grades 4-5. Negative change occurred at the high school level as follows: -6.7 NCE's in the Regular group and -9.2 NCE's in the CAI/CMS group.

Based on Average Daily Membership, CAI/CMS teachers served more pupils per teacher than did Regular program teachers at all three levels. CAI/CMS teachers served 11.4 more pupils per teacher at the elementary level, 8.4 more pupils per teacher at the high school level, and 0.8 more pupils per teacher in middle school. Based on the percent of pupils attaining program attendance criteria, CAI/CMS pupils surpassed Regular pupils in attendance at all three levels. The CAI/CMS group surpassed the Regular group in attendance criterion by 9.1% in high school, by 2.3% in elementary (grades 4-5), and by 1.8% in middle school.

Recommendations: (1) The use of CAI/CMS should be continued and possibly expanded at the middle school and elementary levels; (2) any continuance of the CAI/CMS program at the high school level should be accompanied by a careful review of the present program to identify problem areas and propose solutions.

COST-BENEFIT ANALYSIS FOR ECIA CHAPTER 1 AND STATE DPPF PROGRAMS COMPARING GROUPS RECEIVING REGULAR PROGRAM INSTRUCTION AND GROUPS RECEIVING COMPUTER ASSISTED INSTRUCTION/COMPUTER MANAGEMENT SYSTEM (CAI/CMS)

July 1987

Introduction

The Columbus Public Schools' Title I/Chapter 1 programs have been in operation since 1968. Many of the materials and equipment were purchased in the early years of the program. The cost of replacing worn-out, lost, or stolen equipment and updating materials would be very costly. There was also the necessity of increasing the number of pupils served with the same number of instructional staff. As a solution to the problems that were facing compensatory education administrators, computer reading laboratories were leased in order to alleviate equipment, materials, and enrollment problems. There was also a desire of program administrators to demonstrate that computer assisted instruction/computer management system (CAI/CMS) was effective in compensatory education classrooms. The use of computers was a departure from the conventional reading laboratory.

A cost benefit study was conducted to determine the effectiveness of the computer assisted instruction as an alternative to the conventional method of teaching reading. Analysis was based on cost outlay for the computer laboratory, teachers, and aides. Comparative analysis between CAI/CMS units and conventional laboratories was done in terms of enrollment, attendance, and achievement. The following pages describe the methodology and rationale in doing the analysis as well as the findings. Summary and Recommendations are included.

Type of School/Type of Computer/Company Providing Service

The number of teachers serving in the CAI/CMS projects, according to level of school, type of computer, and company providing service are summarized below.

Table 1

Type of Computer and Service Company
Reported by Organizational Level

Level of School	Type of Computer/Servicing Company					Totals by School Level
	Apple/ PL	TRS-80/ B&B	Sperry/ Wasatch	Microhost/ CCC	Dolphin Houghton-Mifflin	
Elementary	22	4	1	2		29
Middle School			1		6	7
High School	8					8
Totals by Computer Type	30	4	2	2	6	44

Base Figures for Cost Analysis

Average salary plus fringes for DFSP Teachers

Elementary	40,026.91
Middle School	37,117.24
High School	37,936.26
Elementary School Aides (Maximum)	11,610.62

Leasing and contract costs for Prescription Learning (PL) Company - elementary and high school

Elementary	
Leasing and contract for 12 labs	241,200.00
Contract only for 10 labs	113,000.00
Total Elementary PL	354,200.00
High School	
Leasing and contract for 8 labs (Third year of lease/purchase agreement)	175,900.00
Total lease/contract costs for PL Company, Elementary + High School	521,100.00

Contract Costs for 6 Dolphin labs - middle school

Software License Agreement (Houghton-Mitflin Co.)	20,020.00
Maintenance Agreement (Kalbro Co.)	28,252.80
Total Costs for Dolphin Labs	48,272.80

Contract costs for 2 Sperry computer labs - elementary and middle school (1 each)

Software and Service Agreement (Wasatch Co.)	15,775.00
Three-year Lease/Purchase Agreement, first year payment (Handled through Municipal Leasing Corp.)	17,209.80
Total Costs for Sperry Labs	32,984.80

Sperry Lab Costs by School Level

Elementary (1 lab)	16,492.40
Middle School (1 lab)	16,492.40
Total	32,984.80

Contract cost for 3 Tandy TRS-80 computers (used by 4 teachers) - elementary

Maintenance Agreement (B&B Computer Service) 14,000

Contract cost for CCC Microhost (serving 2 teachers) - elementary

Leasing Agreement (Computer Curriculum Corp) 26,949.00

Normal supplies and incidental costs were not known in regard to the separate program subcomponents, but were assumed to be evenly distributed across program subcomponents.

Program Costs

Elementary CLEAR, Regular program (units serving grades 4-5 in public schools)

4.4 Teachers*	@ 40,026.91	176,118.40
	Total program cost	176,118.40
	Number of teachers	4.4
	Cost per teacher unit	40,026.91

* Four teachers taught grades 4-5 only. An additional full-time equivalency of 0.4 was computed based on the proportion of fourth and fifth grade pupils in two additional classrooms which also served the lower grades.

Elementary CLEAR-CAI (grades 4-5 with CAI/CMS)

29 Teachers	@ 40,026.91	1,160,780.39
26 Aides	@ 11,610.62	301,876.12
Total elementary PL leasing and contract costs		354,200.00
Total elementary contract cost for Sperry lab		16,492.40
Total contract cost for Tandy TRS-80 computers		14,000.00
Total contract cost for CCC Microhost		26,949.00
Total program cost		1,874,297.91
	Number of teachers	29
	Cost per teacher unit	64,630.96

Middle School CLEAR, Regular program (grades 6-8)

17 Teachers	@ 37,117.24	630,993.08
	Total program cost	630,993.08
	Number of teachers	17
	Cost per teacher unit	37,117.24

Middle School CLEAR-CAI (grades 6-8 with CAI/CMS)		
7 Teachers	@ 37,117.24	259,820.68
Total contract costs for Dolphin labs		48,272.80
Total middle school contract costs for Sperry lab		16,492.40
	Total program cost	324,585.88
	Number of teachers	7
	Cost per teacher unit	46,369.41
SDR, Regular program (grades 9-10)		
6 Teachers	@ 37,936.26	227,617.56
	Total program cost	227,617.56
	Number of teachers	6
	Cost per teacher unit	37,936.26
SDR-PL (grades 9-10 with CAI/CMS)		
8 Teachers	@ 37,936.26	303,490.08
PL Contract Cost (Total for high school)		175,900.00
	Total program cost	479,390.08
	Number of teachers	8
	Cost per teacher unit	59,923.76

Table 2

Benefit Analysis for 1986-87 ECIA Chapter 1 and State DPPF Programs Comparing Groups Receiving Regular Program Instruction and Groups Receiving Computer Assisted Instruction/Computer Management System (CAI/CMS)

Program	Number of Teachers	Program Cost		Pupils in Program			Pupils per Teacher			Cost per Pupil			Ratio of Sample to Pupils Served	Average NCE Gain
		Total	Per Teacher	Served	In Sample	Average Daily Membership	Served	In Sample	Average Daily Membership	Served	In Sample	Average Daily Membership		
CLEAR grades 4-5 (Regular group)	4.4	176,118.40	40,026.91	235	161	190.4	53.4	36.6	43.3	749.44	1093.90	924.99	68.5%	3.9
CLEAR-CAI (grades 4-5 with CAI/CMS)	29	1,874,297.91	64,630.96	1838	1264	1586.5	63.4	43.6	54.7	1019.75	1482.83	1181.40	68.8%	5.2
CLEAR grades 6-8 (Regular group)	1/	630,993.08	3/,117.24	932	555	774.6	54.8	32.6	45.6	677.03	1136.92	814.61	59.5%	4.6
CLEAR-CAI (Grades 6-8 with CAI/CMS)	7	324,585.88	46,369.41	372	227	313.7	53.1	32.4	44.8	872.54	1429.89	1034.70	61.0%	7.4
SDR grades 9-10 (Regular group)	6	227,617.56	37,936.26	323	134	254.5	53.8	22.3	42.4	704.70	1698.64	894.37	41.5%	- 6.7
SDR-PL (Grades 9-10 with CAI/CMS)	8	479,390.08	59,923.76	486	223	406.0	60.8	27.9	50.8	986.40	2149.73	1180.76	45.9%	- 9.2

Highlights of Cost-Benefit Analysis Table

The truest "cost per pupil" figures reported in Table 2 would be those based on Average Daily Membership. On that basis the following will be noted:

1. At the elementary level (grades 4-5) the cost per pupil was $256.41 more for the CAI/CMS group than for the Regular group.

2. At the middle school level (grades 6-8) the cost per pupil was $220.09 higher for the CAI/CMS group than for the Regular group

3. At the high school level (grades 9-10) the cost per pupil was $286.39 higher for the CAI/CMS group than for the Regular group. It should also be noted that costs for the high school CAI/CMS group included the final payment of a three-year lease/purchase agreement for the computers.

When average NCE gains are compared, the following will be noted:

1. Average NCE gains in grades 4-5 were 1.3 NCE's higher in the CAI/CMS group than in the Regular group.

2. Average NCE gains at the middle school level were 2.8 NCE's higher in the CAI/CMS group than in the Regular group.

3. At the high school level, both groups made negative changes. The negative change was somewhat less severe in the Regular group, being -6.7, as compared to -9.2 in the CAI/CMS group.

At the elementary and high school levels, more pupils were served per teacher in the CAI/CMS groups than in the Regular groups. This was especially notable at the elementary level, where the Average Daily Membership was 11.4 per teacher more in the CAI/CMS group than in the Regular group. The high school CAI/CMS group served an average daily membership of 8.4 pupils per teacher more than did the Regular high school group. There was little difference between the two middle school groups in class membership. The middle school Regular group served an average daily membership of 0.8 pupil per teacher more than did the middle school CAI/CMS group.

Another factor which might be considered is the number of pupils served who qualify for inclusion in the evaluation sample. To qualify for the sample, a pupil must have attended at least 80% of the program days and received both a pretest and a posttest. A small number of the pupils were also excluded from the sample on the basis of being non-English speaking. Therefore, the percent of pupils served who are included in the evaluation sample is not a strict index of attendance alone but gives a rough indication of attendance confounded by other factors. When the ratio of pupils in the sample to total pupils served was examined, the CAI/CMS groups were seen to surpass the Regular groups in this respect, but to varying degrees. Specifically, it was noted that:

1. The ratio was only slightly higher for the CAI/CMS group than for the Regular group at the elementary level (0.3% higher).

2. At the middle school level, the ratio was 1.5% higher for the CAI/CMS group than for the Regular group.

3. At the high school level, the ratio was 4.4% higher for the CAI/CMS group than for the Regular group.

Separate data are also available on the number of pupils who met the 80% attendance criterion without regard to other factors in sample inclusion. These data are summarized in Table 3. The percent of pupils attaining the attendance criterion was seen to be greater in the CAI/CMS groups than in the Regular groups at each of the three school levels. The most notable difference was at the high school level, where 9.1% more pupils achieved the attendance criterion in the CAI/CMS group than in the Regular group. The differences at the elementary and middle school levels were 2.3% and 1.8%, respectively.

Table 3

Comparison of Regular and CAI/CMS Groups
of ECIA Chapter 1 and State DPPF Programs
in Regard to Attainment of the Attendance Criterion

Program	Pupils Served	Pupils Attaining Attendance Criterion	
		Number	Percent
CLEAR Grades 4-5 (Regular group)	235	167	71.1%
CLEAR-PL (Grades 4-5 with CAI/CMS)	1838	1350	73.4%
CLEAR Grades 6-8 (Regular group)	932	602	64.6%
CLEAR-CAI (Grades 6-8 with CAI/CMS)	372	247	66.4%
SDR Grades 9-10 (Regular group)	323	154	47.7%
SDR-PL (Grades 9-10 with CAI/CMS)	486	276	56.8%

Summary

The cost per pupil was greater in the CAI/CMS groups than in the Regular groups at all three levels. The CAI/CMS groups surpassed the Regular groups in average NCE gains at the middle school and elementary levels, but not at the high school level. The CAI/CMS group surpassed the Regular group by 2.8 NCE's at the middle school level, and by 1.3 NCE's in grades 4-5. There was negative change in both groups at the high school level, but there was a difference of 2.5 NCE's in favor of the Regular group.

At the elementary and high school levels, more pupils were served per teacher in the CAI/CMS groups than in the Regular groups. Based on Average Daily Membership, elementary CAI/CMS teachers served an average of 11.4 more pupils per teacher than did teachers in the Regular elementary program, and high school CAI/CMS teachers served an average of 8.4 more pupils per teacher than in the Regular high school group. At the middle school level there was little difference in average daily membership, with the Regular group serving 0.8 pupil more than the CAI/CMS group.

In comparing the percent of pupils attaining the program attendance criterion, data indicated that the high school CAI/CMS group surpassed the high school Regular group by 9.1%, that the elementary CAI/CMS group surpassed the Regular elementary group by 2.3%, and that the middle school CAI/CMS group surpassed the Regular middle school group by 1.8%.

Recommendations

The recommendations are:

1. The use of CAI/CMS should be continued at the middle school and elementary levels, and expansion at these levels might also be considered.

2. If the CAI/CMS program is to continue at the high school level, a careful review of the present program is indicated. Problem areas should be identified, and solutions proposed. Positive aspects of the program should also be identified. One approach that is suggested would be to form a focus group comprised of all project teachers.